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ARCHAEOLOGICAL TEST EXCAVATIONS NEAR THE MOUTH AREA OF
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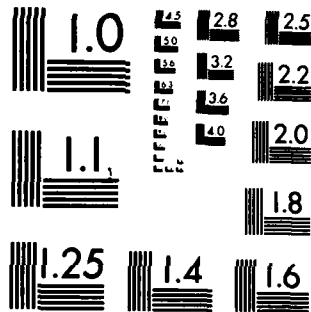
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Archaeological Test Excavations Near the Mouth Area of Kahoma Stream, Lahaina, Maui

by
Hamilton M. Ahlo, Jr.
Maurice E. Morgenstein

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INTRODUCTION

Under the auspices of the Pacific Ocean Division, Corps of Engineers, U.S. Army, Hawaii Marine Research personnel conducted an archaeological survey of the mouth area of Kahoma Stream, Lahaina, Maui. The area extends along the south bank of the stream from Front Street seaward to the coast. The work was undertaken to assist in the planning for and environmental assessment of a proposed flood control project along the stream.

The scope of the work described here was restricted to surface and limited subsurface investigation with the intent of collecting sufficient information to assess the general nature of cultural resources in the area. (See Figure 1 for boundaries of project area.)

The fieldwork was conducted by one author (Ahlo) and Laura A. Carter, Hawaii Marine Research Archaeologists. Dr. Maurice E. Morgenstein performed the sedimentological analyses on samples brought back to the laboratory from one excavation unit.

PREVIOUS WORK

No less than five previous archaeological investigations of the project area have been conducted within the last seven years. Of these, three have been directly a result of the Kahoma Stream Flood Control Project (Connolly, 1974; Hommon, 1973; Joerger and Kaschko, 1979) while two others (Hammatt, 1978; A. Sinoto, 1975) were conducted in association with construction of improvements to the Mala Wharf Boat Launching Ramp.

The report by Joerger and Kaschko (1979) was a literature review only and no archaeological fieldwork was conducted. Of the four reports that did entail archaeological survey within the project area, certain

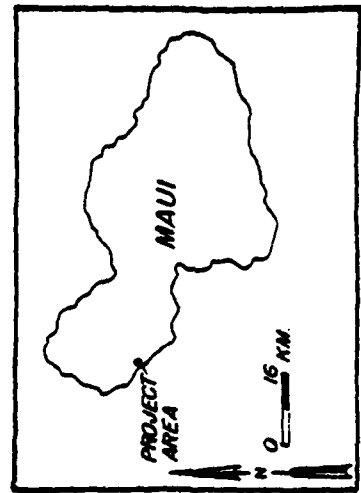
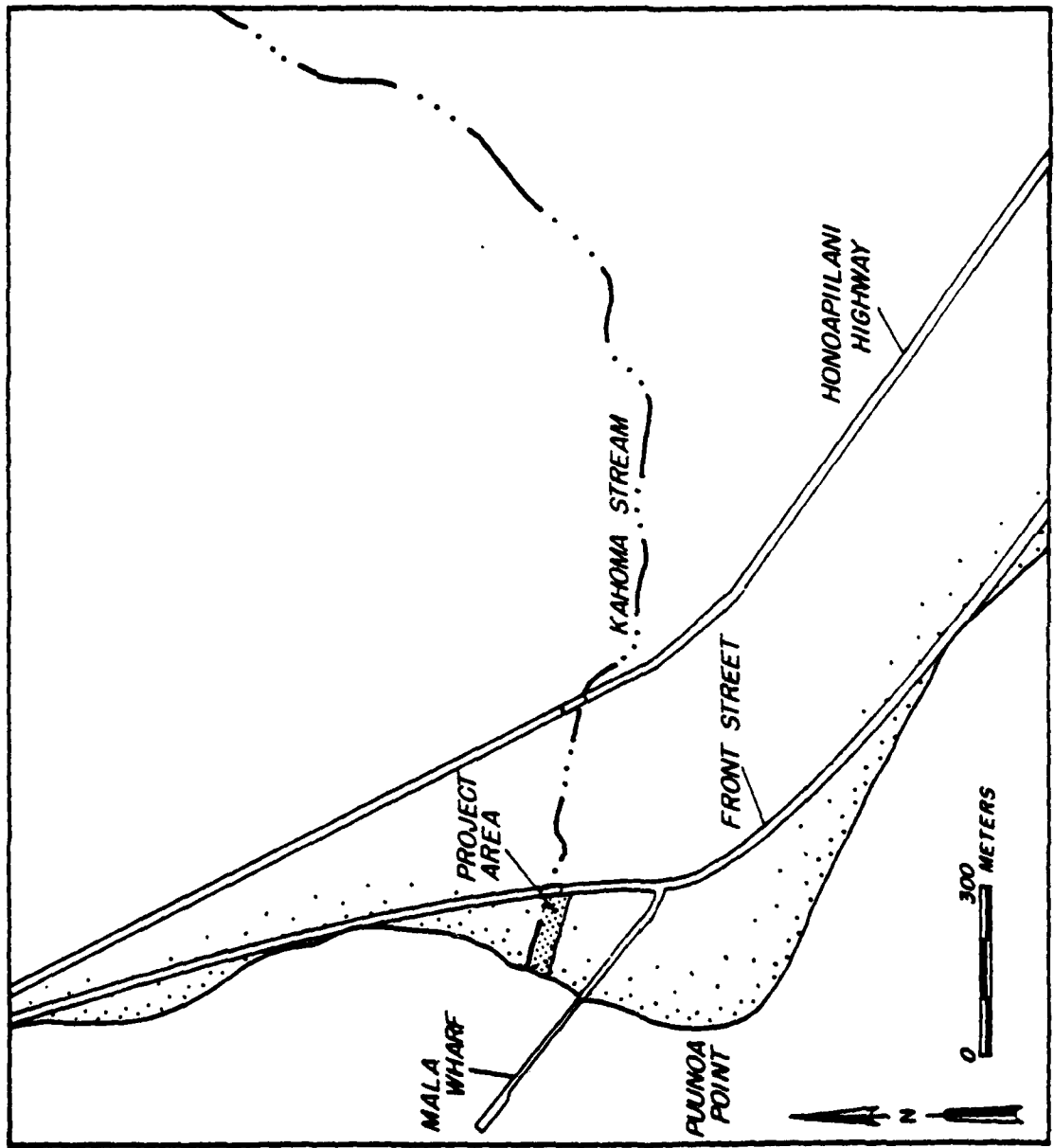


Figure 1. Project Location Map.

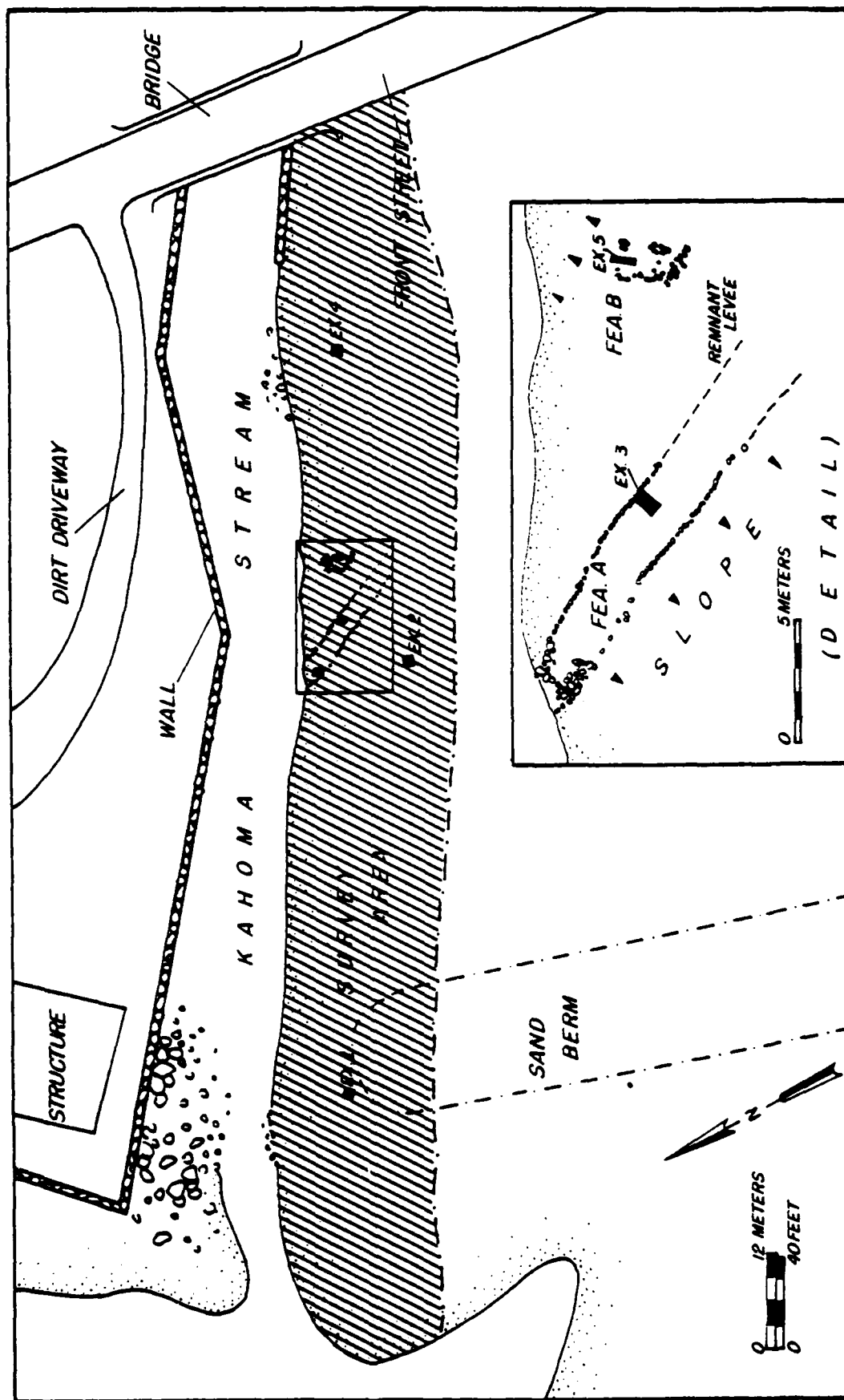


Figure 2. Survey Areas Showing Features and Excavation Units.

discrepancies have been noted among those reports and between them and the findings of our study. The following brief summary of the findings of each of the earlier reports relevant to the work discussed here provides a basis for comparison among them and later comparison of them with our findings.

In July of 1973 a reconnaissance survey of the Kahoma Stream was conducted by the B. P. Bishop Museum under the direction of Robert J. Hommon. Except for the presence of a number of burials in the existing berm area immediately east of the existing parking area and boat launch ramp, no archaeological features were found within their survey area. In 1974 another more intensive survey conducted by the B. P. Bishop Museum was undertaken along Kahoma Stream (Connolly, 1974). This survey again noted the presence of numerous burials in the existing berm area but did not record any other archaeological material along the south bank between Front Street and the coast. A third survey of the Kahoma Stream mouth area was conducted by the B. P. Bishop Museum in 1975, in conjunction with construction of the boat launching ramp and parking area (Sinoto, 1975). In addition to noting the burials on the berm, Sinoto also noted two burials east of the berm close to the banks of the stream and one possible imu (underground oven) east of the berm and approximately 40 meters south of the stream bank. No other archaeological features were recorded. In 1978 Dr. Hallett H. Hammatt supervised the monitoring of the removal of 90 human burials from the berm area. In addition, the area along the south bank of Kahoma Stream was examined. Hammatt noted the presence of an historic imu (probably the same one identified by Sinoto earlier), an 'auwai (water diversion ditch) and two additional features. Though the rest of Hammatt's report does not describe the two features he

noted, the location of his Feature 2 closely corresponds to Sinoto's Burial #1 while Hammatt's Feature 1 closely corresponds in location to Sinoto's Burial #2. The same two items are probably being described by both authors.

Sinoto's report did not contain any descriptive details regarding the surface evidence that led him to conclude that the features he labelled Burials 1 and 2 were in fact burials. Similarly Hammatt's report does not contain any descriptive material at all on Features 1 and 2. As such, it is impossible on the basis of these reports alone to conclusively determine whether these two features/burials in fact refer to the same thing.

Of all the previous investigations, only Hammatt noted the presence of the 'auwai in the area.

A test excavation conducted by Hammatt along the southern edge of the Flood Control Project Area confirmed the presence of a thin cultural deposit including charcoal, shell midden and one basaltic flake (1978:14). Further south along the berm, another test excavation located additional prehistoric cultural material. Though this is outside of the Flood Control Project Area, it does signify probable prehistoric use of the area.

In addition to the test trenches described above, Hammatt also placed one test excavation in the area early maps refer to as a fishpond and one excavation within the 'auwai. No stratigraphic descriptions were given in the report and thus comparison among test trenches excavated by Hammatt and between those and our excavations are limited.

No prehistoric burials were located by any of the previous researchers in or near the Flood Control Project Area.

Two of the earlier studies also surveyed areas upstream of the project area (Hommon, 1973; Connolly, 1974). Hommon's work was a brief reconnaissance while Connolly's work was a more intensive survey. One major

terrace system containing "36 terraces, two ditches (water diversion channels), seven cement structures, and four free standing walls" was located (Connolly, 1974:ii).

Previous investigators had been aware of the presence of a possible fishpond extending south from the south bank of Kahoma Stream. The pond is now known as 'Alamihi. The pond may have been used at least until 1953 when the Territory granted a permit to Shizuko Suehiro to use the pond (Joerger and Kaschko 1979:10). Whether the pond was utilized for aquaculture then is unknown.

Assuming that the pond referred to in early surveys was in fact a body of standing water, the pond appears to have decreased in size significantly from 1908 until present. The following table lists the area of the pond as measured by various observers during the last 70 years.

<u>Date</u>	<u>Measured by</u>	<u>Area (Acres)</u>
1908	Survey Department, Territory of Hawaii	5.230
1917	Survey Department, Territory of Hawaii	4.070
1939	Spencer Tinker (ms.)	2.400
1953	Department of Taxation	2.417
April, 1980		No standing water visible

In the later 1920s, 13,400 cubic yards of fill material was added to the pond as part of a public works improvement project to the Mala Wharf area (Joerger and Kaschko 1979:10). Though it is unclear exactly where this material was put, it is probable that the area filled lies along the existing access road to Mala Wharf. This road was built through the middle of the fishpond.

Clearly the pond has been filled very rapidly, probably by alluviation and/or intentional filling by man. These factors, combined with a probable drop in the water table during this century, rapidly decreased the utility

of the pond for aquaculture. Topographically the section of the pond area nearest the stream would have been the last remnant of standing water and may have been a swamp until the early 1960s.

'Alamihi does not appear to have been particularly important during the last century in terms of its productivity (Joerger and Kaschko 1979:12). In fact, by 1900 no commercially productive fishponds were recorded for Maui (Cobb, 1902:430-431).

Kikuchi (1973:256) refers to the pond along Kahoma Stream as Alanuhi [sic]. He classifies it as a loko pu'uone (his Type II): "an isolated shore fishpond usually formed by the development of barrier beaches building a single elongated sand ridge parallel to the coast and containing one or more sluice gates" (Kikuchi, 1973:228).

Previous work suggested the presence of a fishpond, an associated 'auwai and some evidence of a subsurface cultural deposit on the existing berm. The fishpond sediments were shown to contain land snail deposits and were felt to be a potentially important source of environmental information (Hammatt, 1978). The historical significance of the area was discussed only by Connolly (1974), Joerger and Kaschko (1979), and Apple and Kikuchi (1975).

Connolly concluded that "other than the burials, no sites within the [his] survey area justify any further archaeological work" (1974:12). Joerger and Kaschko suggested that 'Alamihi Fishpond is eligible for inclusion on the National Register of Historic Places by virtue of its association with "prominent historic individuals (David Malo and Kamehameha)," its association with "important historic events (the battle between Kamehameha and Kauhi)," and "its likelihood to yield information important to prehistory" (1979:20).

Joerger and Kaschko concluded that the Flood Control Project could have an adverse impact on the following kinds of archaeological data:

1. The fishpond itself and its sediment fill possibly containing valuable preserved materials including land snails, and the associated structural remains adjacent to Kahoma Stream.
2. Subsurface prehistoric occupation deposits located around the perimeter of the fishpond and bank of Kahoma Stream, and possibly associated with its operation.
3. Human burials both historic and prehistoric located in and around the large sand berm, including some within the fishpond.

[Kaschko and Joerger 1979:21]

In the process of evaluating fishponds throughout Hawaii for their eligibility for inclusion on the National Register of Historic Places, Apple and Kikuchi (1975) compiled an inventory of fishponds throughout the Hawaiian islands. A total of 335 fishponds were initially identified. The ponds were then evaluated in terms of how closely they approximated what Apple and Kikuchi felt were the conditions of the ponds in A.D. 1800. The basin, contents, and setting of each pond were evaluated and assigned a number from 0 to 3, with 3 indicating the ideal pond conditions. Both Apple and Kikuchi then rated each pond on each of the three factors and averaged their ratings.

Though 'Alamihi pond was among the 335 initially identified, it was not believed to possess sufficient integrity to qualify for inclusion on the National Register of Historic Places. Both Hammatt (1978:19) and Joerger and Kaschko, however, felt that a more detailed examination of the pond area was necessary prior to any further ground-disturbing activities. The present study was intended to implement those recommendations.

PRESENT STUDY

The Corps of Engineers requested this study in order to more thoroughly assess the impact of the Kahoma Stream Flood Control Project on any resources within the project area. The scope of the study was to include a literature review, "on the ground examination of the project area, limited test excavations and an estimation of the time and cost for preserving, recovering or otherwise mitigating possible adverse effects on any discovered sites." (Scope of Work, 12 March 1980). The survey was to focus on the southeast bank of Kahoma Stream near its mouth. In addition, the effort was to be "sufficient to adequately assess the general nature of potentially important cultural resources not previously identified" (ibid.).

To accomplish these ends, an intensive survey was undertaken along the south bank of Kahoma Stream during the week of April 21, 1980. The project area parallels the south bank of Kahoma Stream from the coast to Front Street and extends about 25 meters inland from the stream bank (Figures 1 and 2). Roughly perpendicular to the stream and extending south from it is a raised beach berm (Hammatt, 1978:2) approximately 35 meters wide and 4.5 meters high. The berm forms the western border of the fishpond area. Based on a test excavation at the northern edge of the berm, Hammatt describes it as follows:

Stratigraphic profiles . . . show distinct superimposed beds of medium to coarse sand-sized coralline fragments with internal pebble lines. Bedding planes generally dip away from the ocean. These deposits are definitely waterlain rather than windlain as indicated by grain size and sedimentary characteristics . . . Deposits were laid down in a moderate to high energy depositional environment not generally conducive to the preservation of "in situ" cultural material and occupation layers. However, in three test trenches, buried surfaces indicating a significant phase of geomorphic stability and soil development on

the berm, were located at depth [sic] varying from 60 cm. to 120 cm. and thickness [sic] varying from 10 to 30 cm.

[Hammatt 1979:14]

Dominant vegetation in the project area includes kiawe (Prosopis pallida), 'ilima (Sida fallax) and various other weedy species.

Kahoma is an intermittent stream originating in the West Maui Mountains at the base of Kaho'olewa ridge. It is joined by Kahaha Stream, a tributary approximately three kilometers upstream from the project area. Though the area near the headwater of Kahoma Stream receives in excess of 150 inches of rain per year, the project area receives less than 15 inches per year (Armstrong, 1973:56). It is probable that the stream was once perennial but diversion of water from the stream to irrigate sugar cane fields, a drop in the water table near the project area due to sugar cane irrigation and increased water use by a growing population resulted in a decreased flow. Today the stream's flow is quite irregular. During the fieldwork described here, the water level in the stream varied by approximately 50 centimeters within a 24-hour period in which no rain in the Lahaina coastal area was noted.

The portion of the project area inland of the berm has been substantially affected by alluviation and erosion caused by the stream. Large trees have also fallen into the stream; the soil at their base having been eroded away.

Recent historic litter is sparse but evenly distributed throughout the area. The western end of the project area contains numerous concrete fragments as though a concrete structure in the area had been demolished and the debris left behind. A 1940 Board of Harbor Commissioners map showing Lahaina Harbor, Mala Wharf and Approach (Joerger and Kaschko, 1979:11) shows four fuel tanks (probably associated with boat operations

from the wharf) and two additional unidentified rectangular structures in the area. The fuel tanks were removed when the parking area was paved. The concrete may represent the remnants of the unidentified structures, their foundations and/or the fuel tank foundations. This area appears to have been extensively disturbed recently.

Systematic examination of the project area by two Hawaii Marine Research personnel revealed the presence of only two archaeological features. One of these was an 'auwai previously described and mapped by Hammatt (1978) and the other a possible imu which we presume by its location to be Hammatt's Feature 2 (ibid.). As there are no feature descriptions in Hammatt's report, we cannot confirm this.

Though we attempted to locate Hammatt's Feature 1, we did not find it. Again, lacking a description of this feature, our examination was limited to a search for any sign of cultural material in the area.

As mentioned above, Sinoto recorded two burials in this same general area, one of which (Burial 1) is probably Hammatt's Feature 1. This report also lacked any feature descriptions and as such we can neither confirm nor deny the existence of two burials within this area.

An historic imu located east of the base of the berm approximately 35 meters from the stream bank and outside the project area was also noticed. This feature is also on the maps prepared by Sinoto and Hammatt.

Throughout the area numerous large trees have been cut down recently with a chain saw. The trees are still sound with little rot present and were probably cut within the last five years. It is not known why or by whom the trees were felled.

Except for the 'auwai and the possible imu, the area lacks any surface indication of archaeological material. The only evidence that a

fishpond might have existed in the area is the 'auwai leading into the stream. No discernable borders or clearly defined relief suggesting anything more than a low-lying area subject to occasional flooding were found.

Feature Descriptions

Only two archaeological features were noted during our examination of the area. The first, Feature A, is an 'auwai and extends approximately 17 meters from Kahoma Stream in a south-southeasterly (145° magnetic) direction. The 'auwai retains a stone facing for portions of its length. This facing varies from 26 to 53 centimeters in height. The functional depth of the portion of the 'auwai masonry visible today is greater however in that both sides of the 'auwai extend above the masonry from 20 to 50 centimeters. There is no trace of a mākāhā (sluice gate) at the stream end of the feature. The portion of the 'auwai facing near the stream has collapsed due to erosion of the stream bank. The southeastern end of the 'auwai is unfaced and its remnant levee gradually disappears as it tapers downward to the level of the surrounding terrain.

As can be seen in Figure 2, the 'auwai leads into the stream at an acute angle from the pond downstream into the river.

The second feature, B, is a roughly square depression (1.5 meters on a side) with a crude stone alignment along its southeast and southwest sides (Figure 2). Paralleling its southwest side is another rock alignment (two stones wide) suggesting a retaining wall. Remnants of this latter alignment can be traced for a distance of eight meters. Recent historic trash within the depression suggest the area is still used. The stones along the sides of this depression are all dense waterworn vesicular basalt, suggesting conscious selection of the stone for those attributes since a

random selection of stones from the stream would not produce so homogeneous an assemblage. On the basis of the size and form of this feature and the presence of vesicular stones, commonly used in imu, we suspected it was an imu.

The retaining wall along the southwest side of the depression is somewhat enigmatic in that if the depression is an imu, the relation between it and this wall is by no means clear. Apple and Kikuchi (1975:23,34) suggest that guard houses were a common feature near 'auwai and mākāhā. This retaining wall may represent the only remaining surface indication of such a house. This area is on relatively high ground and is also quite flat and would present the most desirable area near the 'auwai for construction of a house. If the area were subjected to periodic flooding, a retaining wall around this flat area would have served to protect the structures from erosion during mild flooding. No direct surface indication that any structure ever stood there was visible.

Test Excavations

A total of five small test excavations were completed within the project area.

Though it was initially felt that the area near the mouth of the stream north and seaward of the berm should have been tested, the extensive disturbance in that area made the likelihood of locating any archaeological deposits there very low. Close examination of the stream bank also revealed no evidence of buried archaeological deposits. As such, we decided to locate the test excavations to secure sediment data from the fishpond and 'auwai and to test the hypothesis that Feature B was an imu. It was felt that the probability of test pits so located yielding archaeologically

important data was higher than if the same number of pits were distributed throughout the larger area (including the disturbed mouth area).

Though previous work by Hammatt (1978:14,15) revealed a prehistoric cultural layer on the berm, it was felt that to attempt to locate this probably discontinuous, thin and indistinct layer would have served no useful purpose other than to possibly confirm its existence. Given the limited time available, it was felt that the question of the fishpond's significance would be a more productive avenue of investigation.

Excavation Unit 1 was a single sounding placed on the slope of the berm to determine the general composition of the upper 50 centimeters of berm sediments. The sounding was 50 centimeters square and yielded no cultural material other than recent bottle glass and ceramic fragments down to the 46 centimeter level. Five pieces of bottle glass representing three bottles and two fragments of ceramic items (one porcelain and one glazed pottery) were found. Three layers distinguishable only on the basis of color were observed. All were composed of coarse- to medium-grained biocarbonate sandy loam with occasional charcoal flecks distributed throughout all three layers. Contact between layers was clear and smooth. The color of Layers I (0 to 11/22 centimeters) and III (16/25 centimeters to bottom) was 5YR 2.5/3 (dark reddish brown), while that of Layer II (11/16 to 22/25 centimeters) was 5YR 3/3 (dark reddish brown).

Excavation Units 2, 3 and 4 were situated to determine whether the fishpond sediments noted by Hammatt (1978:16) were present here and if they were to evaluate their significance.

Excavation Unit 2 was placed on a relatively flat low-lying area approximately 15 meters west of the 'auwai (Feature A). This area represents one of the lowest points in the project area where we suspected the

pond once stood. Layer I (0 to 16/20 centimeters) was composed of clay loam with abundant recent historic debris throughout. Its color was 5YR 3/2, dark reddish brown. Layers II (16/20 to 28/30 centimeters) and III (28/30 centimeters to bottom) are essentially similar to Layers II and III in Excavation Unit 4 (see the discussion on this excavation unit for further information). The total depth of the sounding was 45 centimeters.

Excavation Unit 3 was placed along the side of the 'auwai to examine its sediments and determine the depth of the facing along the sides of the 'auwai. Layer I within this excavation unit was similar to Layer I of Excavation Units 2 and 4. It extends from 0 to 72/78 centimeters, and is composed of clay loam with abundant bottle glass fragments throughout. Layer II appears essentially identical to Layer III of Excavation Unit 4 and the reader is referred to the detailed discussion of that test pit for further information.

The boundary between Layers I and II in Excavation Unit 3 was approximately the level of the water table. The sediment in this layer was very moist and water could be observed seeping into the pit from this layer. The pit was left open for 24 hours during which time the water level in it rose to the bottom of Layer I.

Hammatt (1978:16) also excavated a small trench within the 'auwai and found it was stone-lined on both sides and at its base to a depth of 90 centimeters.

Our excavation stopped at the 90-centimeter level in this excavation unit due to the constant water seepage and the difficulty in removing the wet material. The stone face of the 'auwai however continued down into the base of this pit and it is probable that a stone-lined bottom similar to that observed by Hammatt was present beneath the saturated material.

Excavation Unit 5 was a shallow sounding placed through the southeast edge of the imu (Feature B), to a maximum depth of 33 centimeters. The soil was homogeneous throughout with abundant recent debris scattered within it. Abundant charcoal flecks, very poor sorting, and numerous pockets of highly oxidized soil (10R 3/3 to 10R 4/6, dusky red to red) and the recent debris suggest that this was in fact an imu that has been filled in recently and that is probably recent.

Excavation Unit 4

This test pit was one meter square and was dug down to a level of one meter with an additional small sounding in its southwest corner to a total depth of 1.35 meters. The sediments of Layer III in this pit corresponded to those of Layer III of Excavation Unit 2 and Layer II of Excavation Unit 3.

Layer I 0 to 51/54 centimeters, clay loam, 5YR 2.5/4, dark reddish brown, apedal; roots abundant, fine to coarse, internal sand (60 percent mineral clastics, 40 percent biocarbonate) lenses, pebble lines, abundant historic debris throughout especially bottle glass, charcoal flecks common.

Layer II 55/61 centimeters to 83/84 centimeters (lab analysis) mud 7.5YR 2/4 to 5YR 3/4, very dark brown to dark reddish brown, oxidizing, moist, consisting of 65 percent clay, 30 percent silt, three percent sand, and two percent coarse sand-sized constituents (by visual estimate), ponded alluvial sediment with a sharp to slightly wavy bottom contact to Layer III at a depth of 83 to 84 centimeters below surface. The sediment is uniform in texture except for pockets and scatterings of terrigenous gastropods.

Layer III 83/84 centimeters to 135 centimeters (bottom). Mud reducing, moist, consisting of 70 percent clay, 26 percent silt, two percent sand and two percent coarse sand-sized constituents (by visual estimate), ponded alluvial sediment with the bottom contact at an undetermined depth below the ground water table. The sediment is uniform in texture except for pockets and scatterings of terrigenous gastropods. Maximum sediment thickness measured was 52 centimeters. Top level of this layer corresponds to level of the water table.

Sediment samples from Layers III and IV were taken and analyzed in the laboratory (Table I). The sediment was prepared on smear slides for fine fraction sedimentary petrology. Five-gram samples from each layer were washed with water and were sieved in a 3.8-micron sieve to remove the clay fraction. The sediment was then oven dried and analyzed microscopically. Results of this analysis are shown in Table I.

Two species of benthic foraminifera [Ammonia sp. (?) and Elphidium sp. (?)] were observed consisting of fragmented tests, whole tests and pitted tests. These appear to be clastic particles derived from dune or beach sediments and cannot be attributed to the cosmopolitan pond assemblage discussed below. Additionally they have hydraulic radii similar to associated clastic biocarbonate sand grains which are well-rounded and derived from echinoid spines, coral, periwinkle and crustacean carapaces.

The ostracod Cyprideis beaonensis was observed in both samples as intact juvenile-to-adult forms and as shells showing bilateral segmentation without fragmentation. Some of the shells showed clay fillings, however most appeared as either fresh (as in Layer II) or unfilled (as in Layer III). C. beaonensis appears to be a cosmopolitan ostracod species associated with the pond because of the volume of individuals, the lack of fragmentation, and the differences in hydraulic radii between the ostracods and the biocarbonate clastics in which they are found.

We have tentatively identified two micro-gastropods which are probably species of the brackish water melanid of the family Thiaridae. These also have a larger hydraulic radii than the carbonate clastics surrounding them and appear unfragmented and unpitted. Both the micro-gastropods and ostracod appear as cosmopolitan brackish water fauna.

TABLE I
MICROSOPIC COMPARISON OF SAMPLES FOR EXCAVATION UNIT 4

<u>Constituent</u>	<u>Layer II</u>	<u>Layer III</u>
<u>Silt-Sized Fraction</u>		
Igneous minerals (olivine, feldspar, pyroxene, magnetite)	80%	80%
Sideromelane	1	1
Palagonite	15	10
Biocarbonate (clastics)	1	1
Undecomposed organics (including pollen)	3	3
Reduced organics (black)	<u><1</u>	<u>5</u>
TOTAL	100%	100%
<u>Sand-Sized Fraction</u>		
Igneous minerals	80%	60%
Palagonite	10	11
Sideromelane	1	1
Iron reduced-coated igneous rock fragments	0	2
Reduced organics	0	16
Undecomposed organics	5	8
Phytoliths	<1	<1
Biocarbonate clastics	<u>4</u>	<u>2</u>
TOTAL	100%	100%
<u>Coarse Sand-Sized Fraction</u>		
Reduced (decomposed organics - black)	0%	40%
Undecomposed (wood/organics/seed pods)	3	<1
Igneous rock fragments basalts, rounded grains	1	1
Igneous minerals	2	2
Sideromelane	1	1
Bottle glass (white and green)	1	0
Terrigenous gastropods	40	25
Unidentified carbonate shell fragments	20	10
Biocarbonate clastics	15	10
Rounded coral fragments	trace	trace
Periwinkle fragments	trace	trace
Benthonic foraminifera	trace	trace
Echinoid spine fragments	trace	trace
Crustacean carapace fragments	none	none
Biocarbonate cosmopolitan species	<u>17</u>	<u>10</u>
Ostracods (<u>C. beaenensis</u>)		
Micro-gastropod (<u>Thiaridae</u>)		
TOTAL	100%	100%

Several species of terrigenous gastropods were observed and are more numerous than the micro-gastropods. These probably represent the major skeletal forms associated with the wet lands once adjacent to the pond.

The inorganic mineral fraction of both sediment samples appears to be similar and in part derived from a high energy environment as attested to by rounding of the grains.

The organic flora components show variation between samples with the sample from Layer IV containing significant concentrations of reduced debris accounting for the color variation between the samples. It is anticipated that with continued deposition and accompanying diagenesis, the sedimentary contact between the two samples will become wavy and the biocarbonate fraction will show significant leaching effects.

DISCUSSION

Sediment Analysis

Brief investigations of the micro-faunal components of the 'Alamihi Pond and its inorganic constituents indicate two sedimentary sources:

1. Beach/berm system - inorganic and biocarbonate clastics appear to wash into the 'Alamihi Pond during periods of high surf and onshore breezes.
2. The inorganic fine clay fraction appears to be deposited during stream flooding phases with the predominant deposition occurring during cataclysmic flooding with thick and rapid accumulation of fine sediments and with the rapid burial of cosmopolitan micro-fauna of both the pond shoreline (terrigenous gastropods) and the species which occupy the brackish water within the pond environment. Minor periods of stream action contribute to a slow

accumulation of terrigenous sediments and a supply of fresh water to the pond system.

Cataclysmic deposition (flooding) is indicated by the presence of historic bottle glass fragments at significant depths (60 to 80 centimeters) below the surface as well as the pocketing and layering of terrigenous gastropods within the sedimentary column.

The sediments analyzed during this study appear to be historically derived via the above mechanisms. We suspect that prehistoric sediments may underlie those observed.

Pond Function

Very little is known about the various factors involved in successful prehistoric Hawaiian aquaculture or the mechanics and architecture of aquacultural water control features. The intimate relationships between aquatic fauna and flora and other environmental parameters (e.g., water chemistry, substrate geology, water temperature, solar radiation, flushing and circulation, nutrient influx) within a functioning prehistoric fishpond remains unexplored. The little data available are primarily descriptions of remaining aquacultural features (Summers, 1964; Kikuchi, 1973; Apple and Kikuchi, 1975). The following discussion should be regarded as a speculative attempt to explore the possible explanations for the features noted during this study.

The two features of possible archaeological interest within the project area are the 'auwai and the pond sediments.

As mentioned earlier, the 'auwai is somewhat puzzling in terms of its orientation to the flow of water into the stream. If its primary function were to direct water into the stream it could do so more effectively if it

were angled upstream. If it functioned primarily to control water flow out of the pond, a question arises as to where the water within the pond originated.

Assuming the pond was used to raise fish, two possibilities are evident. First, water may have been channeled into the pond from an 'auwai further upstream than the existing 'auwai or from an 'auwai south of the project area leading into the pond from the sea. Circulation, flushing and water residence times within the pond could be controlled by regulating water intake through either or both of these sources. Neither this study nor any of the previous studies noted any trace of a second 'auwai leading from the stream into the pond or from the ocean into the pond.

A second possible source of water for the pond may have been periodic flooding. Little is known either about the frequency and severity of flooding in the area over the last few hundred years, or the topography of the area prior to agricultural and residential modifications to the land and consequently whether sufficient water would have been available for the particular use to which the pond was put.

On the basis of our brief sediment analysis, it is not possible to conclude that the pond was actually used to raise fish. Discussions with several area residents confirmed that they had heard it once was a fish-pond but had not actually witnessed it being used as such. The cosmopolitan micro-gastropod and ostracod species present suggest that the pond environment, at least during the period those skeletal remnants were deposited, was brackish. When this was temporally is unknown. Similar sediments could have originated both in a natural pond or a rice paddy.

The presence of the 'auwai indicates that at least during some portion of the pond's history someone attempted to control water ingress to and/or egress from the pond.

A third use of the 'auwai and pond without significant water control is possible. The pond may have been a natural body of standing water periodically refreshed during flooding. Given certain minor changes in coastline configuration and assuming certain species of fish swam far enough up the stream, the 'auwai could represent a remnant of a seasonally used fish trap which served to direct fish into the pond area from the stream. A weir across the stream from the 'auwai could have directed and trapped brackish-tolerant marine fishes in the pond where they could be harvested either then or at some later date. The pond may then have functioned more as a temporary holding tank than as a place fish were bred and raised in captivity, and actual water control may not have been necessary.

CONCLUSIONS AND RECOMMENDATIONS

Given the current state of knowledge of fishpond operation, sedimentary deposition and diagenesis within fishponds, and lacking any detailed information on land modifications and hydrologic variation through time in the Mala area, little can be said about the function of the pond.

We know that the pond environment, as indicated by the sediments we observed, was primarily brackish and populated by various cosmopolitan micro-gastropods and ostracods. We know, as evidenced by the 'auwai, that an attempt to control water ingress to and/or egress from the pond may have been made. Alternatively this feature may indicate a fish trap of some sort.

Historic and recent use of the area is indicated by the burials removed by Hammatt (1978), the two historic 'imu, and the recent litter throughout the area.

We suspect that the stream was at one time perennial and the ground water table in the area was once higher. Consequently, the prehistoric environment would have been more suitable for aquaculture than it is today.

We cannot conclusively establish that the pond was used to raise and keep fish.

Further, more intensive study (both areally and analytically) based on large numbers of corings throughout the beach and pond area may yield additional information, but such a study would be primarily exploratory and it is not known how germane any information obtained would be to further interpretation of fishpond use and significance. Certainly, such detailed subsurface contour mapping of the pond sediments would yield detailed sedimentological and environmental data (micro fauna and flora remains), and could provide an extremely valuable aid in the interpretation of any archaeological remains, but, lacking any significant archaeological deposits, their utility is limited.

If prehistoric sediments occur below the sediments observed here, there is a possibility that they could contain well-preserved environmental and archaeological information. This possibility would be enhanced if deposition were as rapid as appears to have been the case with the sediments observed here. In general, the sediments above the water table examined appear to be, on the basis of our limited sample, historic and lack any archaeological significance.

The 'auwai is essentially an isolated feature and its age cannot be accurately determined. It could be associated with an historic rice paddy as well as a prehistoric fishpond or trap. In either case it is not, in and of itself, likely to yield information important in prehistory. As such, we

do not consider it eligible for inclusion on the National Register of Historic Places.

Though no surface indications now exist, there is a high probability of encountering additional burials within the project area during construction (Hammatt, 1978:17). There is also a possibility that additional cultural material similar to that noted in the existing berm by Hammatt exists (1978:14,15) though the probability of this should be considered low. For these reasons we recommend that all ground disturbance activities in the area be monitored by an archaeologist and all burial removal and reinterment be carried out in accordance with Department of Health regulations.

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